

Height Modernization Forum Agenda

Washington State Department of Transportation
Spokane, WA
September 15, 2004

Time	Topic	Presenter(s)
8:30 am	Registration	
9:00 am	Greetings and Introductions	Gary Perasso (NGS)
9:10 am	National Height Modernization Program: Overview	Juliana Blackwell (NGS)
9:45 am	Height Modernization Primer: GPS-derived Heights, Datums, and Coordinates	Renee Shields (NGS)
10:30 am	Break	
10:45 am	Spatial Reference Center of Washington	Spencer Reeder (SRCW)
12:15 pm	Introduction and Identification of Discussion Topics, Small Focus Group Instructions and Example	Philip Heller
12:45 pm	Lunch (on your own)	
2:00 pm	Small Focus Group Discussions	Attendees
3:00 pm	Break	
3:15 pm	Small Focus Group Reports	Attendees
3:45 pm	Wrap-up, Questions and Answers	Gilbert Mitchell (NGS) & All
4:00 pm	Adjourn	Philip Heller

Height Modernization Initiative

GPS Guided
Aircraft Operations



GPS Subsidence
Monitoring



GPS Buoy
Monitoring Water Levels



GPS Tie to
Tidal Bench Marks



GPS Monitoring
of Infrastructures



GPS Controlled
Photogrammetry



GPS Positioning of Ship's
Pitch, Roll and Squat

IMPLEMENTATION OF NATIONAL HEIGHT MODERNIZATION WITHIN WASHINGTON STATE

Problem: Today, state and local governments spend tens of millions of dollars each year correcting engineering projects that are continually affected by changing land surfaces due to subsidence, crustal plate movements of the earth, floods, earthquakes, and other natural phenomena. For example, the Northridge, California, earthquake in 1994 required more than \$1 million in Federal government expenditure for the extensive resurveying that had to be done as a result of the earthquake.

The indirect costs associated with the inability to adjust for elevation change may result in even greater costs. Examples include:

- Crop irrigation can be rendered inefficient, wasting the use of available water and increasing the demand for more infrastructure to divert limited water supplies.
- Storm drainage management can become less predictable, resulting in higher insurance rates and a greater need to build additional storm sewers.

Use of the 750,000 precisely located, in-ground or monumented reference points installed over the past 200 years to measure heights is not by itself adequate to meet the needs of today's mobile and technology-driven society. The classical line-of-sight measurements do not provide the real-time accuracy needed for today's positioning technologies and applications, including precision agriculture, efficient marine transportation, and zero visibility landings of aircraft.

Solution: Through the use of the Global Positioning System (GPS), a constellation of 24 high altitude (11,000 miles) NAVSTAR satellites operated by the U.S. military and originally designed for use as an advanced weapons delivery system first deployed in the 1980's, pinpoint positioning accuracies can be provided 24 hours a day. The combination of an improved national height system (North American Vertical Datum of 1988) first adopted by the Federal government in 1993, along with the positioning technology of GPS, offers the nation and its governments, for the first time, the ability to obtain precise vertical measurements in real-time.

Applications: Integrating the horizontal, vertical, and gravity control networks into a unified national positioning system, joined and maintained by GPS, and administered by the National Geodetic Survey, sets the stage for many advances. A state-of-the-art National Spatial Reference System, with NAVD 88 as its elevation reference, can make available to the nation a common, consistent set of real-time geographical coordinates, or reference points. The application of this break-through national positioning system can provide:

- Improved aircraft navigational aids, and safer approach and landing procedures;
- Advanced surface transportation control and monitoring;
- Highly efficient fertilizer and pesticide spreading, resulting in reduced run-off water pollution;
- More accurate modeling of storm surge and pollution trajectories;
- Increased accuracy for improved resource management decision making;
- Significant time savings in field surveying; and
- Improved disaster preparedness and earthquake detection.



PANGA GPS base station on PuPu Point, DNR property

Proposal: A group of government and private representatives from across Washington State has formed a non-profit organization called the Spatial Reference Center of Washington (SRCW). This organization will be directed by the Spatial Reference Council, which is currently made up of representatives from the Departments of Natural Resources and Transportation, the National Geodetic Survey, Counties of Snohomish and Pierce, Cities of Seattle and Renton, several private firms (GeoLine, ESRI, and W&H Pacific), and the Associations; Land Surveyor's Association of Washington, Washington State Section of the American Congress on Surveying & Mapping, Washington Geographic Information Council, and the Washington Council of County Surveyors. The SRCW has worked with Senator Murray's office and obtained line item funding of height modernization in Washington State for the Federal FY04. Current funding is for \$500,000 with a requested funding level of \$2,500,000 for the next four years (supported by Senator Murray and Congressman Dicks). SRCW staff will be housed at the Natural Resource Building and sponsored by the Department of Natural Resources. Fieldwork will primarily be accomplished through engineering and land surveying firms hired through contracts by the SRCW.

SRCW activities:

- Verification of existing geodetic control across Washington
- Remeasure, through vertical leveling techniques, approximately 5,000 kilometers of benchmarks and GPS base stations.
- Construct an array of about 80 GPS base stations across Washington (about 50 new stations are needed).
- Build the data infrastructure to serve the public through the Internet and through cell phone technology.
- Develop a maintenance plan to sustain this system into the future.

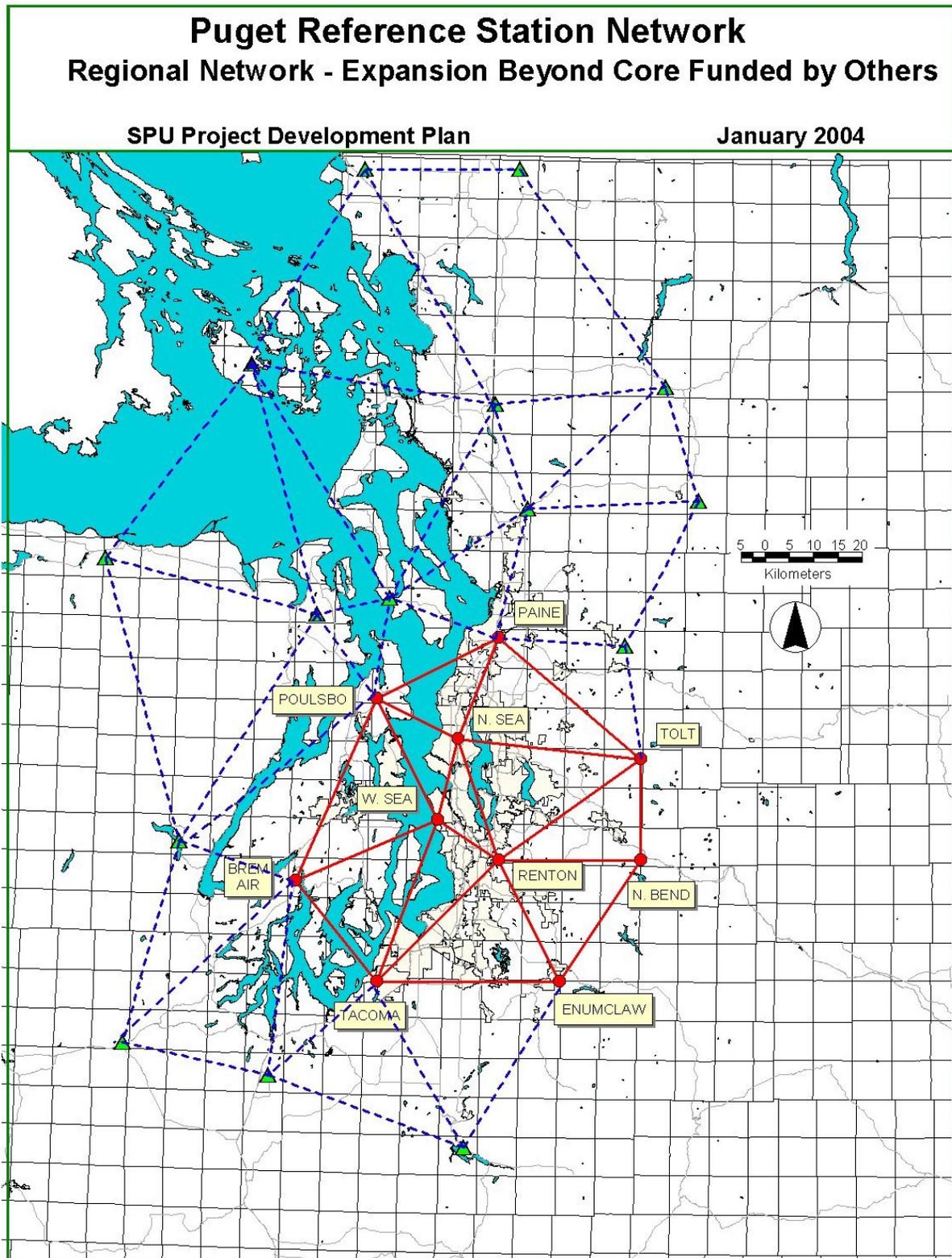
Benefits Associated with National Height Modernization Project:

- Replace labor-intensive, high-cost leveling procedures with new cost-efficient GPS technology.
- Decreased survey costs associated with flood plain and other mapping and GIS activities.
- Increased efficiency and accuracy of water delivery and drainage systems.
- Improved aircraft navigational aids and safer approach and landing procedures.
- Advanced surface transportation control and monitoring.
- Highly efficient fertilizer and pesticide spreading, resulting in reduced run-off water pollution.
- More accurate modeling of storm surge and pollution trajectories.
- Improved disaster preparedness and earthquake detection.

Note: This document was provided by the National Geodetic Survey and modified for use in Washington State. The original document can be found at:

<http://www.ngs.noaa.gov/initiatives/HeightMod/NAVD88HM/NAVD88HM3.htm>

Currently, a local effort in Puget Sound (PRSN) is building the initial footprint of the future statewide system. A picture of that system is shown below



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